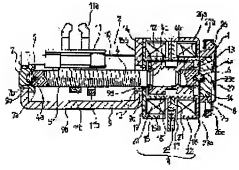
PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-219946
(43)Date of publication of application : 19.08.1997

(51)Int.Cl. H02K 1/28
H02K 1/27
H02K 37/14
H02K 37/24

(21)Application number : 08-048101 (71)Applicant : SANKYO SEIKI MFG CO LTD
(22)Date of filing : 09.02.1996 (72)Inventor : OZAWA SHIGERU
SONOHARA HIROYUKI

(54) ROTOR FOR SMALL MOTOR



(57)Abstract:
PROBLEM TO BE SOLVED: To definitely prevent slippage and pull-out between a rotor shaft and a rotor magnet by a simple configuration.
SOLUTION: This rotor 1 has a rotor magnet 12 and a rotor shaft 4, and stripe-shaped grooves 4b and 4c forming a groove portion which has a pull-out preventing function against a rotor magnet 12 is formed in the rotor shaft 4. Then, the rotor shaft 4 and the rotor magnet 12 are fixed with a fixing material 14 as fixing means placed in the grooves 4b and 4c and through part of the rotor magnet 12 entering into the grooves 4b and 4c.

CLAIMS

[Claim(s)]

[Claim 1]A rotor for size motors characterized by fixing the above-mentioned rotor shaft and the above-mentioned rotor magnet via a fixing means which has a rotor magnet and a rotor shaft, forms a slot which has a preventing function in the above-mentioned rotor shaft keep receiving the above-mentioned rotor magnet, and goes into the slot.

[Claim 2]A rotor for size motors characterized by fixing the above-mentioned rotor shaft and the above-mentioned rotor magnet via a bridging which has a rotor magnet and a rotor shaft, formed a slot of at least one shape of ** which has a preventing function in the above-mentioned rotor shaft keep receiving the above-mentioned rotor magnet, and was put into the slot.

[Claim 3]Have a rotor magnet and a rotor shaft and a slot of at least one shape of ** which has a preventing function in the above-mentioned rotor shaft keep receiving the above-mentioned rotor magnet is formed, A rotor for size motors having made some above-mentioned rotor magnets fit into the slot, and fixing the above-mentioned rotor shaft and the above-mentioned rotor magnet.

[Claim 4]A rotor for the size motors according to claim 2 or 3 making a slot of the shape of said ** into ring shape with which both ends were connected.

[Claim 5]A rotor for the size motors according to claim 2 or 3, wherein it used a slot of the shape of said ** as a slot which consists of two or more sections, and it is for reverse and at least one of slots of the shape of ** of this plurality forms in piles with a slot of the shape of other ** to a slot of the shape of other **.

[Claim 6]A rotor for the size motors according to claim 2 or 3 having formed a leading-screw part which engages and moves member turning to said rotor shaft, having made this leading-screw part extend to a contact part with said rotor magnet, and

using a slot of this leading screw as a slot of the shape of said **.

[Claim 7]A rotor for the size motors according to claim 2 or 3 having faced and formed a part of slot of the shape of said ** in a crevice established in an axial edge face of said rotor magnet, and putting a bridging into this slot and the above-mentioned crevice.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the fixing structure of the suitable rotor magnet and rotor shaft for the rotor for stepping motors especially about the rotor for small electric motors.

[0002]

[Description of the Prior Art]As conventionally shown in drawing 11, the stepping motor 50 with which the leading-screw part 52 was formed in the rotor shaft 51 has structure supported by the two thrust blocks 53 and 54 in the both ends of the rotor shaft 51, respectively. And the thrust-block 54 side has further composition which supports a radial direction by the metal bearing 55. The rotor magnet 57 has adhered to the rotor shaft 51 so that it may counter with the stator part 56 and few crevices. This bearing 54 comprised the flat spring 58 and the ball 59, and has responded to thrust loading of the rotor shaft 51 movable by the spring pressure of this flat spring 58. On the other hand, the stator part 56 side is being fixed to the frame 60 by fixing the stator part 56 to the tie-down plate 61, and fixing this tie-down plate 61 to the frame 60 with a screw thread. In the case of this immobilization, it is used for positioning of the metal bearing 55.

[0003]And in order to fix the rotor shaft 51 and the rotor magnet 57, it is carrying out by pressing the rotor shaft 51 of straight shape fit into the rotor magnet 57. by this press fit,

the rotor magnet 57 receives the rotor shaft 51 -- a hand of cut -- a position gap -- that is, the rotor shaft 51 is kept from falling out to a thrust direction so that it may not be idle

[0004]

[Problem(s) to be Solved by the Invention]However, when it presses fit strongly noting that I will raise the intensity to rotation since the rotor in the stepping motor 50 of the structure shown in such drawing 11 presses the rotor shaft 51 fit in the rotor magnet 57 and is fixing to it, there is a possibility that the rotor magnet 57 may break. In particular, the danger becomes high when the rotor magnet 57 is thin. On the other hand, if light pressure ON is used, the intensity to rotation will be lost and the rotor magnet 57 will be idle to the rotor shaft 51. Thus, adjustment of the press fit intensity is very difficult.

[0005]a crack of such a rotor magnet 57 -- being idle (position gap) -- not only the case where the rotor magnet 57 is thin but when using the rotor magnet 57 with small radial crushing strength, there is a possibility that it may be generated similarly.

[0006]In order to perform press fit immobilization, it is necessary to raise the accuracy of the inner diameter dimension of the rotor magnet 57, or the outside diameter size of the rotor shaft 51. For this reason, time and cost started processing of the rotor magnet 57 and the rotor shaft 51, and aggravation of productive efficiency and a cost rise are caused. And to use the thin rotor magnet 57 and the rotor magnet 57 with small radial crushing strength as mentioned above, it is necessary to raise accuracy further and to make predetermined fixing strength hold. As a result, it is also a cause which obstructs the miniaturization of a motor, highly-efficient-izing, low cost-ization, etc.

[0007]An object of this invention is to provide the rotor for the size motors between a rotor shaft and a rotor magnet which were idle and prevented ****** certainly with easy composition.

[0008]

[Means for Solving the Problem]In order to attain this purpose, in a rotor for the size motors according to claim 1, it has a rotor magnet and a rotor shaft, and a slot which has a preventing function keep receiving a rotor magnet is formed in a rotor shaft, and a rotor shaft and a rotor magnet are fixed to it via a fixing means included in the slot.

[0009]In a rotor for the size motors according to claim 2, it has a rotor magnet and a rotor shaft, and a slot of at least one shape of ** which has a preventing function keep receiving a rotor magnet is formed in a rotor shaft, and a rotor shaft and a rotor magnet are fixed to it via a bridging put into the slot.

[0010]In a rotor for the size motors according to claim 3. Have a rotor magnet and a rotor shaft, and form a slot of at least one shape of ** which has a preventing function in a rotor shaft keep receiving a rotor magnet, some rotor magnets are made to fit into the slot, and a rotor shaft and a rotor magnet are fixed.

[0011]In the invention according to claim 4, a **-like slot is made into ring shape with which both ends were connected in a rotor for the size motors according to claim 2 or 3. In addition, in the invention according to claim 5, in a rotor for the size motors according to claim 2 or 3, a **-like slot is used as a slot which consists of two or more sections, to a slot of the shape of other **, it is for reverse and at least one of slots of the shape of ** of this plurality forms in piles with a slot of the shape of other **.

[0012]In a rotor for the size motors according to claim 2 or 3 by the invention according to claim 6, Form a leading-screw part which engages and moves member turning to a rotor shaft, this leading-screw part is made to extend to a contact part with a rotor magnet, and a slot of this leading screw is used as a **-like slot. In the invention according to claim 7, in a rotor for the size motors according to claim 2 or 3, a part of **-like slot is faced and formed in a crevice established in an axial edge face of a rotor magnet, and a bridging is put into this slot and crevice.

[0013]A rotor for size motors of this invention forms a slot with an omission preventing function, and is fixing a rotor shaft and a rotor magnet via a fixing means included in the slot. And a bridging which put a rotor shaft which there is a **-like slot as an example of this slot, for example, formed a slot of the shape of at least one **, and a rotor magnet into a **-like slot is passed, or some rotor magnets are made to fit into a **-like slot, and it is fixing to it. For this reason, a rotor magnet is idle, some bridgings and rotor magnets which were put into a **-like slot serve as resistance of omission prevention of a ** rotor shaft, it is idle and ****** does not arise. By formation of a slot, a contact surface of a bridging, a rotor magnet, and a rotor shaft becomes large, and the fixing strength itself becomes large. As a slot, it may be made the shape of crepe other than what was formed in a **-like slot.

[0014]If a **-like slot is made into ring shape with which both ends were connected, to the direction of an omission of a rotor shaft, resistance will become strong and will become desirable. If at least one of slots of the shape of two or more ** is made into a thing for reverse with other slots, it will become desirable when a resistance force to both operations of ****** and an omission prevents increase and both phenomena. In addition, if a slot of a leading-screw part established in a rotor shaft is extended as it is and it is considered as a **-like slot, **-like groove formation can carry out simultaneously with groove formation of a leading-screw part. If a crevice is established in an axial edge face of a rotor magnet, the crevice is faced and a part of **-like slot is formed, it will become possible to put a bridging into both portions of a crevice and a slot simultaneously.

[0015]

[Embodiment of the Invention]Hereafter, an embodiment of the invention is described based on drawing 10 from drawing 1. A 1st embodiment is first described based on drawing 7 from drawing 1.

[0016]The rotor 1 of a 1st embodiment is used for the stepping motor 2. And this stepping motor 2 is an object for the drive

of the lens of a video camera, and has the rotor shaft 4 projected from the stator part 3. And the leading-screw part 5 is formed, and the engagement hole 4a of conical shape was formed in both ends, and the steel ball 6 is in contact with the projection side of this rotor shaft 4, respectively. The projection side tip part of the rotor shaft 4 is supported by the bearing 7 which the steel ball 6 intrudes, and the stator side other end is supported by the bearing body 8. Here, in addition to the thrust direction, the bearing 7 of the protrusion tip part of the rotor shaft 4 is a bearing which also supports a radial direction.

[0017]The bearing 7 and the stator part 3 are attached to the frame 9, and the guide shaft 10 is being further fixed to this frame 9. And the rack 11 holding the lens for video cameras is slidably attached to this guide shaft 10.

[0018]The rotor 1 comprises the rotor shaft 4 and the rotor magnet 12 which adheres to the rotor shaft 4. This rotor magnet 12 is a rare earth permanent magnet of NEOJI, iron, and a boron system, and serves as plastic magnet formed of injection. And it is considered as the shape which made it become depressed except the portion which counters the pole gear of the stator part 3 in the shape of the rotor magnet 12, and inertia is made small. The crevice 13 is established in the shaft-orientations both ends of this rotor magnet 12, and the rotor shaft 4 and the rotor magnet 12 are put into the binder 14 used as the bridging for adhering in that crevice 13.

[0019]On the other hand, the portion which constitutes the rotor 1 of the rotor shaft 4 is provided so that it may become the slot 4b of the shape of ** used as two rings, and 4c fang furrow part. And the slot 4b is established in the bearing body 8 side a little from the center of the rotor magnet 12, and the slot 4c is faced and established in the crevice 13 by the side of the bearing 7. Here, the diameter of the rotor shaft 4 is 2 mm, and, on the other hand, the depth of each slots 4b and 4c is 0.3 mm. And when the diameter of the rotor shaft 4 is about 2 mm, it is preferred to use 5% - about 20% of the diameters of the rotor shaft 4, i.e., 0.1 mm - 0.4 mm, as the depth.

[0020]The 1st stator 15 in which the stator part 3 serves as a case, and the 2nd stator 16 that has the pole gear 15a of this 1st stator 15, and a pole gear which becomes intricate by turns, This 2nd stator 16 and the 3rd stator 17 fixed back to back, The 4th stator 18 it has a pole gear of this 3rd stator 17, and a pole gear which becomes intricate by turns, and serves as a case, The coil bobbin 19 of doughnut shape inserted between the 1st stator 15 and the 2nd stator 16, It comprises the coil bobbin 21 of doughnut shape inserted between the coil 20 wound around this coil bobbin 19, and the 3rd stator 17 and the 4th stator 18, and the coil 22 wound around this coil bobbin 21. This composition is the same as that of the stator part of a publicly known stepping motor conventionally.

[0021]It is formed in the center portion of this stator part 3 so that the terminal area 24 which has the terminal 23 connected to the coils 20 and 22 may project in a way outside the 1st stator 15 and the 4th stator 18. The frame 9 side of the 1st stator 15 is made plate-like, and it adheres to the frame 9 by welding, and the insertion hole 15b which the rotor shaft 4 inserts in is formed in the center. Here, as for the crevice between the periphery of this inserted-in rotor shaft 4, and the inner skin of the insertion hole 15b, it is preferred to use beyond the concentricity error of the bearing body 8 and the rotor shaft 4. The inside diameter of the insertion hole 15b is constituted so that it may become below an outer diameter of the rotor magnet 12.

[0022]The leading-screw part 5 formed in the rotor shaft 4 is the same as that of a publicly known leading screw conventionally, and it has a function which rotation of the rotor shaft 4 is made to move to shaft orientations with the rack 11 used as the delivery object which engages with this leading-screw part 5. The move direction of the rack 11 is controlled by changing the hand of cut of the rotor shaft 4.

[0023]The bearing 7 is used as resin bearing and has the ****** part 7a which contacts the periphery at the frame 9. And the crevice 7b which became two steps is formed in the center of the bearing 7, the steel ball 6 fits into the inside side

crevice of a byway, and the rotor shaft 4 is ****(ing) to the outer side crevice of a major diameter. Thereby, support of the 2-way of a thrust direction and a radial direction is possible for this bearing 7.

[0024]The bearing body 8 engages with the resin bearing 25 made of resin, the side plate 26 which holds the resin bearing 25 enabling free movement to shaft orientations, and this side plate 26, and it comprises the thrust-loading spring 27 which presses the regions of back of the resin bearing 25.

[0025]And the projection 25b to which the ball receptacle crevice 25a which holds the steel ball 6 to the resin bearing 25 engages with the guide rail 26b further formed in the one center at the inner surface of the fitting hole 26a of the side plate 26 is formed in the three periphery, respectively.

[0026]The fitting hole 26a where the side plate 26 carries out fitting maintenance of the resin bearing 25 by light pressure ON or ****, The one end 27a of the thrust-loading spring 27 serves as a circular board which has the two suspending portions 26c with the lock projection 26e by which an insertion stop is carried out, and the concave suspending portion 26d by which the other end 27b of the thrust-loading spring 27 is stopped. And the inside diameter of the fitting hole 26a is made larger than the outer diameter of the rotor magnet 12, and it enables it to incorporate the rotor shaft 4 which adhered in the rotor 1 12, i.e., a rotor magnet, after immobilization of the side plate 26. Immobilization in the stator part 3 of the side plate 26 is performed by welding.

[0027]The thrust-loading spring 27 is formed using the metal plate of one sheet. The one end 27a inserted in the suspending portion 26c, the other end 27b stopped by the concave suspending portion 26d, and the three spring parts 27c which bent the remainder which was cut in the shape of a U character, and was lacked to the resin bearing 25 side are formed in this thrust-loading spring 27. [one] And the spring part 27c contacts behind the resin bearing 25, and is pressing the rotor shaft 4 via this resin bearing 25 and the steel ball 6.

[0028]The frame 9 is provided with the following.

The bearing attaching part 9a which is formed in the shape of KO and holds the bearing 7.
The rest 9b for attaching this stepping motor 2 to the holding part of a video camera.
The stator fitting part 9c for adhering the stator 3.
And 9 d of insertion holes are established in the stator fitting part 9c so that crevice sufficient between the rotor shafts 4 may be formed. And the leading-screw part 5 is formed to 9 d of this insertion hole, and the portion which counters.
[0029]One end is fixed to the bearing attaching part 9a of the frame 9, and the other end is being fixed to the stator fitting part 9c, respectively so that it may become parallel [the guide shaft 10] to the rotor shaft 4. And the rack 11 is slidably attached to this guide shaft 10. This rack 11 is that tip part 11a, the lens for video cameras (graphic display abbreviation) is held, and the other end 11b is engaging with the leading-screw part 5.
[0030]If the stepping motor 2 is constituted as mentioned above, even if there is thrust backlash at the time of the assembly of the stepping motor 2, the thrust backlash is absorbed when spring energization of the resin bearing 25 is carried out by the thrust-loading spring 27 in a thrust direction. Since the resin bearing 25 is guided to the side plate 26 at this time, it does not move to a radial direction.
[0031]Here, the assembly of the rotor 1 is performed as follows. First, the rotor magnet 12 is fixed to the rotor shaft 4 by injection in the form which inserts the rotor shaft 4. Then, the binder 14 which consists of ultraviolet curing type anaerobic adhesive is inserted in the crevice 13 by the side of the bearing body 8 of the rotor magnet 12, and ultraviolet rays and temperature are applied and it is made to solidify. Then, the binder 14 of the same kind is inserted in the crevice 13 by the side of the bearing 7 of the rotor magnet 12, and it is made to solidify similarly. Under the present circumstances, the binder 14 enters also in the slot 4c besides this crevice 13, and is solidified in one. Some rotor magnets 12 which enter in the slot 4b constitute a fixing means.

[0032]Next, the assembly of the stepping motor 2 is performed. First, the stator part 3 and the bearing 7 are fixed to the guide shaft 10 and the frame 9 in which the rack 11 was formed. Then, the steel ball 6 is put into the crevice 7b of the bearing 7. And the engagement hole 4a at the tip is dashed for the rotor shaft 4 which has the rotor 1 against the steel ball 6 in the bearing 7 through the fitting hole 26a of the side plate 26, the central hole of the stator part 3, 15 d of insertion holes of the 1st stator, and 9 d of insertion holes of the frame 9. And the steel ball 6 is put into the engagement hole 4a by the side of the stator part 3 of the rotor shaft 4, and the resin bearing 25 is made to intrude the fitting hole 26a of the side plate 26 further, so that the steel ball 6 may enter in the crevice 25a. Finally, the thrust-loading spring 27 is attached to the side plate 26, and it attaches so that the spring part 27c may press the rotor shaft 4 via the resin bearing 25.

[0033]The operation of the stepping motor 1 constituted in this way is as follows. That is, if current flows into the coils 20 and 22 of the stator part 3, by the magnetic mutual action between the stator part 3 and the rotor magnet 12, the rotor 1 will rotate and, as a result, the rotor shaft 4 will rotate. Then, the leading-screw part 5 rotates and the rack 11 is moved to shaft orientations.

[0034]Although the Katha Katha sound occurred or rotation loss had arisen by the metal bearing 55 between two thrust blocks in the conventional stepping motor 50 of drawing 11 at the time of such movement of the rack 11, In this stepping motor 2, since there is no such metal bearing and the crevice is moreover established between the periphery of the rotor shaft 4, and the inner skin of the frame 9, the rotor shaft 4 is not equivalent to the frame 9 or the 1st stator 15. For this reason, it is not generated and, moreover, any sliding loss other than the bearing 7 and the portion of the bearing body 8 does not produce generating of the Katha Katha sound.

[0035]In this embodiment, since there are the **-like slots 4b and 4c, it becomes difficult to shirk the rotor magnet 12 to

the rotor shaft 4, and, moreover, the rotor shaft 4 does not fall out. Since the slot 4c is countered and established in the crevice 13 and it is put into the adhesives 14 in the slot 4c and crevice 13, it becomes what has high adhesive strength.

[0036]In this embodiment, since the inside diameter of the fitting hole 26a of the side plate 26 is made larger than the outer diameter of the rotor magnet 12, after attaching the side plate 26 to the stator part 3, the rotor 1 which has the rotor shaft 4 can be attached. In this embodiment, since 9 d of insertion holes of the frame 9 are enlarged in addition to there being no metal bearing 55 of the conventional center, the long leading-screw part 5 can be taken in the direction of the rotor 1. For example, as shown in drawing 1, a slot spiral to the place of 9 d of insertion holes can be formed. For this reason, the center portion of the leading-screw part 5 used as the most stable pitch can be used for the feeding operation of the rack 11. Since the thrust-loading spring 27 is formed from the metal of one sheet and the spring part 27c etc. are formed in the metal plate, part mark do not increase but, moreover, an assembly becomes easy.

[0037]Next, a 2nd embodiment is described based on drawing 8. This rotor 31 is also used for the stepping motor 32, and this stepping motor 32 as well as a 1st embodiment has become a thing for the lens drive of a video camera. The 1st embodiment and the member are used with being shown with the same numerals in explanation of this embodiment.

[0038]The rotor 31 by which this stepping motor 32 is constituted from the rotor magnet 33 and the rotor shaft 34, The leading-screw part 35 formed in the projection side, and the resin bearing 36 which receives the projection side tip of the rotor shaft 34, The metal bearing 37 which supports the center section of the rotor shaft 4, and the spring 38 which is fixed to the end of the stator part 3 and contacts the end of the rotor shaft 4, The stopper 39 which regulates a motion of the spring 38, and the tie-down plate 40 which fixes the stator part 3, It slides on the frame 41 to which the tie-down plate 40 which fixed the stator 3 adheres, the guide shaft (graphic

display abbreviation) fixed to the frame 41, and its guide shaft, and the part mainly comprises a rack for lens maintenance (graphic display abbreviation) which engages with the leading-screw part 35. Let the tip by the side of the spring 38 of the rotor shaft 34 be the semicircle ball-like end 34a.

[0039]The rotor magnet 33 of the rotor 31 serves as plastic magnet which the whole serves as a rare earth permanent magnet of NEOJI, iron, and a boron system made into cylindrical shape, and was formed of injection. And the crevice 42 is formed in the shaft-orientations both ends of this rotor magnet 33, and the rotor shaft 34 and the rotor magnet 33 are put into the binder 14 used as the bridging for adhering in that crevice 42.

[0040]On the other hand, it is provided in the rotor shaft 34 which constitutes the rotor 31 as the slot 34b of the shape of ** used as the ring, and a 34c fang furrow part. The depth of the slots 34b and 34c shall be 0.3 mm, and let it be about 15% of depth to the diameter (2 mm) of the rotor shaft 34. As for this depth, it is preferred to consider it as 5% - 20% of range like a 1st embodiment.

[0041]The leading screw of the leading-screw part 35 and the stator part 3 are the same as that of a 1st embodiment both conventionally like a publicly known thing. Unlike a 1st embodiment, the leading screw of the leading-screw part 35 is formed only to this side of the bearing 37. Fitting maintenance of the resin bearing 36 is carried out at one bending end 41a of the frame 41, and fitting maintenance of the metal bearing 37 is carried out at the bending end 41b of another side of the frame 41.

[0042]The spring 38 starts the spring part from the metal plate of one sheet, and is slightly bent and formed in the inner direction. And the spring part contacts the end 34a of the rotor shaft 34, and is pressing the rotor shaft 34 to the other side. The stopper 39 holds the spring 38 and he has adhered to the stator part 3 by welding in itself. And the move inhibition function at the time of the rotor shaft 34 having moved to the spring part side is achieved. The tie-down plate 40 fixes the

stator part 3, and it is fixed to the bending end 41b of the frame 41. And a part of metal bearing 37 has fitted into the fitting hole of the center.

[0043]Here, the assembly of the rotor 31 is performed as follows. First, the rotor shaft 34 is inserted in the central hole of the rotor magnet 33. At this time, about 10-100 micrometers of outer diameters of the rotor shaft 34 are made small compared with the inside diameter of the central hole of the rotor magnet 33, and it changes both into the **** state instead of press fit. Then, the binder 14 which consists of ultraviolet curing type anaerobic adhesive is put into one crevice 42 of the rotor magnet 33, and ultraviolet rays and temperature are applied and it is made to solidify. When putting this binder 14 into the crevice 42, some binders 14 will be transmitted in the rotor shaft 34, and the slots 34b and 34c will be covered with it. And although the binder 14 is further put into the crevice 42 of another side of the rotor magnet 33 in a similar manner, also at this time, some binders 14 will be transmitted in the rotor shaft 34, and the slots 34b and 34c will be covered. Then, the binder 14 is solidified similarly.

[0044]Next, the assembly of this stepping motor 32 is explained. First, the resin bearing 36, the metal bearing 37, a guide shaft, and Lack are beforehand attached to the frame 41. On the other hand, to the stator part 3, the rotor 31, the tie-down plate 40, the spring 38, and the stopper 39 are incorporated beforehand, and are attached. And the both are made to unify. This unification is performed by making the projecting end of that rotor shaft 34 insert in the metal bearing 37, and making that tie-down plate 40 fit into that metal bearing 37. Adhesion or welding performs immobilization on the frame 41 of the tie-down plate 40.

[0045]According to this 2nd embodiment, the binder 14 is transmitted in the rotor shaft 34, since the slots 34b and 34c of the shape of ** used as the ring are covered, immobilization with the rotor magnet 33 and the rotor shaft 34 is strengthened, the rotor magnet 33 is idle, and the omission of the ** rotor

shaft 34 is prevented. Here, the binder 14 with which the **-like slots 34b and 34c are covered constitutes a fixing means.

[0046]in addition -- in the range which is not limited to this and does not deviate from the gist of this invention although each above-mentioned embodiment is an example of the suitable embodiment of this invention -- various -- modification -- it is feasible. For example, immobilization with the rotor magnet 33 and the rotor shaft 34 is used as 34 d of slots of the shape of ** of a meshes-of-a-net form provided in the rotor shaft 34 as shown in drawing 9, or as shown in drawing 10, it is good also as the **-like slot 34e to make the slot of the leading screw of the leading-screw part 35 continue as it is. And as a fixing method of the rotor magnet 33 in the dimorphism voice shown in drawing 9 and drawing 10, and the rotor shaft 34, it is good like a 1st embodiment also as any of form which use insertion form or use the binder 14 like a 2nd embodiment.

[0047]These rotors 1 and 31 are applicable to a stepping motor without a leading screw, and they are applicable to other motors, such as not a stepping motor but AC small synchronous motor. The stepping motors 2 and 32 can be used also for the thing of other uses, such as not the object for videos but an object for the head drive of a floppy disk drive, and an object for the pickup drive of CD-ROM.

[0048]As the **-like slots 4b, 4c, 34b, 34c, 34d, and 34e, It may be made to form the **-like slot over the part, i.e., for example, the semicircle grade, of the rotor shafts 4 and 34 instead of the perimeter, i.e., 360 degrees, besides considering it as the ring shape over the perimeter of the rotor shafts 4 and 34, or making it spiral shape. When a spacer is put in between the rotor shafts 4 and 34 and the rotor magnets 12 and 33 and it fixes to it, it is preferred to form the slot of the rotor shafts 4 and 34 and the shape of same ** as the spacer. When forming the rotor magnets 12 and 33, a **-like slot is simultaneously formed in the inner surface of the central hole, and the rotor-shaft 4 and 34 side may be made into a flat cylindrical surface, or it may be made to provide a **-like slot. As a slot, it is good as a crepe-like thing

besides a **-like slot.

[0049]

[Effect of the Invention]As explained above, in the rotor for size motors given in claims 1, 2, 3, and 4. Since slots, such as a **-like slot, are formed in a rotor shaft, bridgings and rotor magnets part, such as a binder used as a fixing means, are put into the slot and the rotor magnet and the rotor shaft are unified, the danger that a rotor magnet will be idle or a rotor shaft will fall out decreases substantially. And since it can form easily by slots', such as a **-like slot's, applying a cutting tool to a rotor shaft, and rotating the rotor shaft etc., cost and productive efficiency do not fall so much compared with the former, either.

[0050]In addition, in the invention according to claim 5, since the slot of the shape of ** for reverse is formed, the omission of a rotor shaft is prevented further. In the invention according to claim 6, since the slot on the leading screw is used as a **-like slot, **-like groove formation can carry out very simply and efficiently.

[0051]In the invention according to claim 7, since the crevice established in the axial edge face of the rotor magnet was countered, a part of **-like slot is arranged and the bridging was put into this slot and crevice, fixing strength becomes high, it is idle and ****** is prevented further.

TECHNICAL FIELD

[Field of the Invention]This invention relates to the fixing structure of the suitable rotor magnet and rotor shaft for the rotor for stepping motors especially about the rotor for small electric motors.

PRIOR ART

[Description of the Prior Art]As conventionally shown in drawing 11, the stepping motor 50 with which the leading-screw part 52 was formed in the rotor shaft 51 has structure supported by the two thrust blocks 53 and 54 in the both ends of the rotor shaft 51, respectively. And the thrust-block 54 side has further composition which supports a radial direction by the metal bearing 55. The rotor magnet 57 has adhered to the rotor shaft 51 so that it may counter with the stator part 56 and few crevices. This bearing 54 comprised the flat spring 58 and the ball 59, and has responded to thrust loading of the rotor shaft 51 movable by the spring pressure of this flat spring 58. On the other hand, the stator part 56 side is being fixed to the frame 60 by fixing the stator part 56 to the tie-down plate 61, and fixing this tie-down plate 61 to the frame 60 with a screw thread. In the case of this immobilization, it is used for positioning of the metal bearing 55.

[0003]And in order to fix the rotor shaft 51 and the rotor magnet 57, it is carrying out by pressing the rotor shaft 51 of straight shape fit into the rotor magnet 57. by this press fit, the rotor magnet 57 receives the rotor shaft 51 -- a hand of cut -- a position gap -- that is, the rotor shaft 51 is kept from falling out to a thrust direction so that it may not be idle

---

EFFECT OF THE INVENTION

[Effect of the Invention]As explained above, in the rotor for size motors given in claims 1, 2, 3, and 4. Since slots, such as a **-like slot, are formed in a rotor shaft, bridgings and rotor magnets part, such as a binder used as a fixing means, are put into the slot and the rotor magnet and the rotor shaft are unified, the danger that a rotor magnet will be idle or a rotor shaft will fall out decreases substantially. And since it can form easily by slots', such as a **-like slot's, applying a cutting tool to a rotor shaft, and rotating the rotor shaft etc., cost and productive efficiency do not fall so much compared with the former, either.

[0050]In addition, in the invention according to claim 5, since the slot of the shape of ** for reverse is formed, the omission of a rotor shaft is prevented further. In the invention according to claim 6, since the slot on the leading screw is used as a **-like slot, **-like groove formation can carry out very simply and efficiently.

[0051]In the invention according to claim 7, since the crevice established in the axial edge face of the rotor magnet was countered, a part of **-like slot is arranged and the bridging was put into this slot and crevice, fixing strength becomes high, it is idle and ****** is prevented further.

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]However, when it presses fit strongly noting that I will raise the intensity to rotation since the rotor in the stepping motor 50 of the structure shown in such drawing 11 presses the rotor shaft 51 fit in the rotor magnet 57 and is fixing to it, there is a possibility that the rotor magnet 57 may break. In particular, the danger becomes high when the rotor magnet 57 is thin. On the other hand, if light pressure ON is used, the intensity to rotation will be lost and the rotor magnet 57 will be idle to the rotor shaft 51. Thus, adjustment of the press fit intensity is very difficult.

[0005]a crack of such a rotor magnet 57 -- being idle (position gap) -- not only the case where the rotor magnet 57 is thin but when using the rotor magnet 57 with small radial crushing strength, there is a possibility that it may be generated similarly.

[0006]In order to perform press fit immobilization, it is necessary to raise the accuracy of the inner diameter dimension of the rotor magnet 57, or the outside diameter size of the rotor shaft 51. For this reason, time and cost started processing of the rotor magnet 57 and the rotor shaft 51, and aggravation of productive efficiency and a cost rise are caused.

And to use the thin rotor magnet 57 and the rotor magnet 57 with small radial crushing strength as mentioned above, it is necessary to raise accuracy further and to make predetermined fixing strength hold. As a result, it is also a cause which obstructs the miniaturization of a motor, highly-efficient-izing, low cost-ization, etc.

[0007]An object of this invention is to provide the rotor for the size motors between a rotor shaft and a rotor magnet which were idle and prevented ****** certainly with easy composition.

MEANS

[Means for Solving the Problem]In order to attain this purpose, in a rotor for the size motors according to claim 1, it has a rotor magnet and a rotor shaft, and a slot which has a preventing function keep receiving a rotor magnet is formed in a rotor shaft, and a rotor shaft and a rotor magnet are fixed to it via a fixing means included in the slot.

[0009]In a rotor for the size motors according to claim 2, it has a rotor magnet and a rotor shaft, and a slot of at least one shape of ** which has a preventing function keep receiving a rotor magnet is formed in a rotor shaft, and a rotor shaft and a rotor magnet are fixed to it via a bridging put into the slot.

[0010]In a rotor for the size motors according to claim 3. Have a rotor magnet and a rotor shaft, and form a slot of at least one shape of ** which has a preventing function in a rotor shaft keep receiving a rotor magnet, some rotor magnets are made to fit into the slot, and a rotor shaft and a rotor magnet are fixed.

[0011]In the invention according to claim 4, a **-like slot is made into ring shape with which both ends were connected in a rotor for the size motors according to claim 2 or 3. In addition, in the invention according to claim 5, in a rotor for the size motors according to claim 2 or 3, a **-like slot is used as a slot which consists of two or more sections, to a slot of the shape of other **, it is for reverse and at least

one of slots of the shape of ** of this plurality forms in piles with a slot of the shape of other **.

[0012]In a rotor for the size motors according to claim 2 or 3 by the invention according to claim 6, Form a leading-screw part which engages and moves member turning to a rotor shaft, this leading-screw part is made to extend to a contact part with a rotor magnet, and a slot of this leading screw is used as a **-like slot. In the invention according to claim 7, in a rotor for the size motors according to claim 2 or 3, a part of **-like slot is faced and formed in a crevice established in an axial edge face of a rotor magnet, and a bridging is put into this slot and crevice.

[0013]A rotor for size motors of this invention forms a slot with an omission preventing function, and is fixing a rotor shaft and a rotor magnet via a fixing means included in the slot. And a bridging which put a rotor shaft which there is a **-like slot as an example of this slot, for example, formed a slot of the shape of at least one **, and a rotor magnet into a **-like slot is passed, or some rotor magnets are made to fit into a **-like slot, and it is fixing to it. For this reason, a rotor magnet is idle, some bridgings and rotor magnets which were put into a **-like slot serve as resistance of omission prevention of a ** rotor shaft, it is idle and ****** does not arise. By formation of a slot, a contact surface of a bridging, a rotor magnet, and a rotor shaft becomes large, and the fixing strength itself becomes large. As a slot, it may be made the shape of crepe other than what was formed in a **-like slot.

[0014]If a **-like slot is made into ring shape with which both ends were connected, to the direction of an omission of a rotor shaft, resistance will become strong and will become desirable. If at least one of slots of the shape of two or more ** is made into a thing for reverse with other slots, it will become desirable when a resistance force to both operations of ****** and an omission prevents increase and both phenomena. In addition, if a slot of a leading-screw part established in a rotor shaft is extended as it is and it is considered as a **-like slot, **-like groove formation can carry out

simultaneously with groove formation of a leading-screw part. If a crevice is established in an axial edge face of a rotor magnet, the crevice is faced and a part of **-like slot is formed, it will become possible to put a bridging into both portions of a crevice and a slot simultaneously.

[0015]

[Embodiment of the Invention]Hereafter, an embodiment of the invention is described based on drawing 10 from drawing 1. A 1st embodiment is first described based on drawing 7 from drawing 1.

[0016]The rotor 1 of a 1st embodiment is used for the stepping motor 2. And this stepping motor 2 is an object for the drive of the lens of a video camera, and has the rotor shaft 4 projected from the stator part 3. And the leading-screw part 5 is formed, and the engagement hole 4a of conical shape was formed in both ends, and the steel ball 6 is in contact with the projection side of this rotor shaft 4, respectively. The projection side tip part of the rotor shaft 4 is supported by the bearing 7 which the steel ball 6 intrudes, and the stator side other end is supported by the bearing body 8. Here, in addition to the thrust direction, the bearing 7 of the protrusion tip part of the rotor shaft 4 is a bearing which also supports a radial direction.

[0017]The bearing 7 and the stator part 3 are attached to the frame 9, and the guide shaft 10 is being further fixed to this frame 9. And the rack 11 holding the lens for video cameras is slidably attached to this guide shaft 10.

[0018]The rotor 1 comprises the rotor shaft 4 and the rotor magnet 12 which adheres to the rotor shaft 4. This rotor magnet 12 is a rare earth permanent magnet of NEOJI, iron, and a boron system, and serves as plastic magnet formed of injection. And it is considered as the shape which made it become depressed except the portion which counters the pole gear of the stator part 3 in the shape of the rotor magnet 12, and inertia is made small. The crevice 13 is established in the shaft-orientations both ends of this rotor magnet 12, and the rotor shaft 4 and the rotor magnet 12 are put into the binder 14 used as the

bridging for adhering in that crevice 13.

[0019]On the other hand, the portion which constitutes the rotor 1 of the rotor shaft 4 is provided so that it may become the slot 4b of the shape of ** used as two rings, and 4c fang furrow part. And the slot 4b is established in the bearing body 8 side a little from the center of the rotor magnet 12, and the slot 4c is faced and established in the crevice 13 by the side of the bearing 7. Here, the diameter of the rotor shaft 4 is 2 mm, and, on the other hand, the depth of each slots 4b and 4c is 0.3 mm. And when the diameter of the rotor shaft 4 is about 2 mm, it is preferred to use 5% - about 20% of the diameters of the rotor shaft 4, i.e., 0.1 mm - 0.4 mm, as the depth.

[0020]The 1st stator 15 in which the stator part 3 serves as a case, and the 2nd stator 16 that has the pole gear 15a of this 1st stator 15, and a pole gear which becomes intricate by turns, This 2nd stator 16 and the 3rd stator 17 fixed back to back, The 4th stator 18 it has a pole gear of this 3rd stator 17, and a pole gear which becomes intricate by turns, and serves as a case, The coil bobbin 19 of doughnut shape inserted between the 1st stator 15 and the 2nd stator 16, It comprises the coil bobbin 21 of doughnut shape inserted between the coil 20 wound around this coil bobbin 19, and the 3rd stator 17 and the 4th stator 18, and the coil 22 wound around this coil bobbin 21. This composition is the same as that of the stator part of a publicly known stepping motor conventionally.

[0021]It is formed in the center portion of this stator part 3 so that the terminal area 24 which has the terminal 23 connected to the coils 20 and 22 may project in a way outside the 1st stator 15 and the 4th stator 18. The frame 9 side of the 1st stator 15 is made plate-like, and it adheres to the frame 9 by welding, and the insertion hole 15b which the rotor shaft 4 inserts in is formed in the center. Here, as for the crevice between the periphery of this inserted-in rotor shaft 4, and the inner skin of the insertion hole 15b, it is preferred to use beyond the concentricity error of the bearing body 8 and the rotor shaft 4. The inside diameter of the insertion hole 15b is constituted so that it may become below an outer

diameter of the rotor magnet 12.

[0022]The leading-screw part 5 formed in the rotor shaft 4 is the same as that of a publicly known leading screw conventionally, and it has a function which rotation of the rotor shaft 4 is made to move to shaft orientations with the rack 11 used as the delivery object which engages with this leading-screw part 5. The move direction of the rack 11 is controlled by changing the hand of cut of the rotor shaft 4.

[0023]The bearing 7 is used as resin bearing and has the ****** part 7a which contacts the periphery at the frame 9. And the crevice 7b which became two steps is formed in the center of the bearing 7, the steel ball 6 fits into the inside side crevice of a byway, and the rotor shaft 4 is ****(ing) to the outer side crevice of a major diameter. Thereby, support of the 2-way of a thrust direction and a radial direction is possible for this bearing 7.

[0024]The bearing body 8 engages with the resin bearing 25 made of resin, the side plate 26 which holds the resin bearing 25 enabling free movement to shaft orientations, and this side plate 26, and it comprises the thrust-loading spring 27 which presses the regions of back of the resin bearing 25.

[0025]And the projection 25b to which the ball receptacle crevice 25a which holds the steel ball 6 to the resin bearing 25 engages with the guide rail 26b further formed in the one center at the inner surface of the fitting hole 26a of the side plate 26 is formed in the three periphery, respectively.

[0026]The fitting hole 26a where the side plate 26 carries out fitting maintenance of the resin bearing 25 by light pressure ON or ****, The one end 27a of the thrust-loading spring 27 serves as a circular board which has the two suspending portions 26c with the lock projection 26e by which an insertion stop is carried out, and the concave suspending portion 26d by which the other end 27b of the thrust-loading spring 27 is stopped. And the inside diameter of the fitting hole 26a is made larger than the outer diameter of the rotor magnet 12, and it enables it to incorporate the rotor shaft 4 which adhered in the rotor 1 12, i.e., a rotor magnet, after immobilization of

the side plate 26. Immobilization in the stator part 3 of the side plate 26 is performed by welding.

[0027]The thrust-loading spring 27 is formed using the metal plate of one sheet. The one end 27a inserted in the suspending portion 26c, the other end 27b stopped by the concave suspending portion 26d, and the three spring parts 27c which bent the remainder which was cut in the shape of a U character, and was lacked to the resin bearing 25 side are formed in this thrust-loading spring 27. [one] And the spring part 27c contacts behind the resin bearing 25, and is pressing the rotor shaft 4 via this resin bearing 25 and the steel ball 6.

[0028]The frame 9 is provided with the following.

The bearing attaching part 9a which is formed in the shape of KO and holds the bearing 7.

The rest 9b for attaching this stepping motor 2 to the holding part of a video camera.

The stator fitting part 9c for adhering the stator 3.

And 9 d of insertion holes are established in the stator fitting part 9c so that crevice sufficient between the rotor shafts 4 may be formed. And the leading-screw part 5 is formed to 9 d of this insertion hole, and the portion which counters.

[0029]One end is fixed to the bearing attaching part 9a of the frame 9, and the other end is being fixed to the stator fitting part 9c, respectively so that it may become parallel [the guide shaft 10] to the rotor shaft 4. And the rack 11 is slidably attached to this guide shaft 10. This rack 11 is that tip part 11a, the lens for video cameras (graphic display abbreviation) is held, and the other end 11b is engaging with the leading-screw part 5.

[0030]If the stepping motor 2 is constituted as mentioned above, even if there is thrust backlash at the time of the assembly of the stepping motor 2, the thrust backlash is absorbed when spring energization of the resin bearing 25 is carried out by the thrust-loading spring 27 in a thrust direction. Since the resin bearing 25 is guided to the side plate 26 at this time, it does not move to a radial direction.

[0031]Here, the assembly of the rotor 1 is performed as follows.

First, the rotor magnet 12 is fixed to the rotor shaft 4 by injection in the form which inserts the rotor shaft 4. Then, the binder 14 which consists of ultraviolet curing type anaerobic adhesive is inserted in the crevice 13 by the side of the bearing body 8 of the rotor magnet 12, and ultraviolet rays and temperature are applied and it is made to solidify. Then, the binder 14 of the same kind is inserted in the crevice 13 by the side of the bearing 7 of the rotor magnet 12, and it is made to solidify similarly. Under the present circumstances, the binder 14 enters also in the slot 4c besides this crevice 13, and is solidified in one. Some rotor magnets 12 which enter in the slot 4b constitute a fixing means.

[0032]Next, the assembly of the stepping motor 2 is performed. First, the stator part 3 and the bearing 7 are fixed to the guide shaft 10 and the frame 9 in which the rack 11 was formed. Then, the steel ball 6 is put into the crevice 7b of the bearing 7. And the engagement hole 4a at the tip is dashed for the rotor shaft 4 which has the rotor 1 against the steel ball 6 in the bearing 7 through the fitting hole 26a of the side plate 26, the central hole of the stator part 3, 15 d of insertion holes of the 1st stator, and 9 d of insertion holes of the frame 9. And the steel ball 6 is put into the engagement hole 4a by the side of the stator part 3 of the rotor shaft 4, and the resin bearing 25 is made to intrude the fitting hole 26a of the side plate 26 further, so that the steel ball 6 may enter in the crevice 25a. Finally, the thrust-loading spring 27 is attached to the side plate 26, and it attaches so that the spring part 27c may press the rotor shaft 4 via the resin bearing 25.

[0033]The operation of the stepping motor 1 constituted in this way is as follows. That is, if current flows into the coils 20 and 22 of the stator part 3, by the magnetic mutual action between the stator part 3 and the rotor magnet 12, the rotor 1 will rotate and, as a result, the rotor shaft 4 will rotate. Then, the leading-screw part 5 rotates and the rack 11 is moved to shaft orientations.

[0034]Although the Katha Katha sound occurred or rotation loss

had arisen by the metal bearing 55 between two thrust blocks in the conventional stepping motor 50 of drawing 11 at the time of such movement of the rack 11, In this stepping motor 2, since there is no such metal bearing and the crevice is moreover established between the periphery of the rotor shaft 4, and the inner skin of the frame 9, the rotor shaft 4 is not equivalent to the frame 9 or the 1st stator 15. For this reason, it is not generated and, moreover, any sliding loss other than the bearing 7 and the portion of the bearing body 8 does not produce generating of the Katha Katha sound.

[0035]In this embodiment, since there are the **-like slots 4b and 4c, it becomes difficult to shirk the rotor magnet 12 to the rotor shaft 4, and, moreover, the rotor shaft 4 does not fall out. Since the slot 4c is countered and established in the crevice 13 and it is put into the adhesives 14 in the slot 4c and crevice 13, it becomes what has high adhesive strength.

[0036]In this embodiment, since the inside diameter of the fitting hole 26a of the side plate 26 is made larger than the outer diameter of the rotor magnet 12, after attaching the side plate 26 to the stator part 3, the rotor 1 which has the rotor shaft 4 can be attached. In this embodiment, since 9 d of insertion holes of the frame 9 are enlarged in addition to there being no metal bearing 55 of the conventional center, the long leading-screw part 5 can be taken in the direction of the rotor 1. For example, as shown in drawing 1, a slot spiral to the place of 9 d of insertion holes can be formed. For this reason, the center portion of the leading-screw part 5 used as the most stable pitch can be used for the feeding operation of the rack 11. Since the thrust-loading spring 27 is formed from the metal of one sheet and the spring part 27c etc. are formed in the metal plate, part mark do not increase but, moreover, an assembly becomes easy.

[0037]Next, a 2nd embodiment is described based on drawing 8. This rotor 31 is also used for the stepping motor 32, and this stepping motor 32 as well as a 1st embodiment has become a thing for the lens drive of a video camera. The 1st embodiment and the member are used with being shown with the same numerals

in explanation of this embodiment.

[0038]The rotor 31 by which this stepping motor 32 is constituted from the rotor magnet 33 and the rotor shaft 34, The leading-screw part 35 formed in the projection side, and the resin bearing 36 which receives the projection side tip of the rotor shaft 34, The metal bearing 37 which supports the center section of the rotor shaft 4, and the spring 38 which is fixed to the end of the stator part 3 and contacts the end of the rotor shaft 4, The stopper 39 which regulates a motion of the spring 38, and the tie-down plate 40 which fixes the stator part 3, It slides on the frame 41 to which the tie-down plate 40 which fixed the stator 3 adheres, the guide shaft (graphic display abbreviation) fixed to the frame 41, and its guide shaft, and the part mainly comprises a rack for lens maintenance (graphic display abbreviation) which engages with the leading-screw part 35. Let the tip by the side of the spring 38 of the rotor shaft 34 be the semicircle ball-like end 34a.

[0039]The rotor magnet 33 of the rotor 31 serves as plastic magnet which the whole serves as a rare earth permanent magnet of NEOJI, iron, and a boron system made into cylindrical shape, and was formed of injection. And the crevice 42 is formed in the shaft-orientations both ends of this rotor magnet 33, and the rotor shaft 34 and the rotor magnet 33 are put into the binder 14 used as the bridging for adhering in that crevice 42.

[0040]On the other hand, it is provided in the rotor shaft 34 which constitutes the rotor 31 as the slot 34b of the shape of ** used as the ring, and a 34c fang furrow part. The depth of the slots 34b and 34c shall be 0.3 mm, and let it be about 15% of depth to the diameter (2 mm) of the rotor shaft 34. As for this depth, it is preferred to consider it as 5% - 20% of range like a 1st embodiment.

[0041]The leading screw of the leading-screw part 35 and the stator part 3 are the same as that of a 1st embodiment both conventionally like a publicly known thing. Unlike a 1st embodiment, the leading screw of the leading-screw part 35 is formed only to this side of the bearing 37. Fitting maintenance

of the resin bearing 36 is carried out at one bending end 41a of the frame 41, and fitting maintenance of the metal bearing 37 is carried out at the bending end 41b of another side of the frame 41.

[0042]The spring 38 starts the spring part from the metal plate of one sheet, and is slightly bent and formed in the inner direction. And the spring part contacts the end 34a of the rotor shaft 34, and is pressing the rotor shaft 34 to the other side. The stopper 39 holds the spring 38 and he has adhered to the stator part 3 by welding in itself. And the move inhibition function at the time of the rotor shaft 34 having moved to the spring part side is achieved. The tie-down plate 40 fixes the stator part 3, and it is fixed to the bending end 41b of the frame 41. And a part of metal bearing 37 has fitted into the fitting hole of the center.

[0043]Here, the assembly of the rotor 31 is performed as follows. First, the rotor shaft 34 is inserted in the central hole of the rotor magnet 33. At this time, about 10-100 micrometers of outer diameters of the rotor shaft 34 are made small compared with the inside diameter of the central hole of the rotor magnet 33, and it changes both into the **** state instead of press fit. Then, the binder 14 which consists of ultraviolet curing type anaerobic adhesive is put into one crevice 42 of the rotor magnet 33, and ultraviolet rays and temperature are applied and it is made to solidify. When putting this binder 14 into the crevice 42, some binders 14 will be transmitted in the rotor shaft 34, and the slots 34b and 34c will be covered with it. And although the binder 14 is further put into the crevice 42 of another side of the rotor magnet 33 in a similar manner, also at this time, some binders 14 will be transmitted in the rotor shaft 34, and the slots 34b and 34c will be covered. Then, the binder 14 is solidified similarly.

[0044]Next, the assembly of this stepping motor 32 is explained. First, the resin bearing 36, the metal bearing 37, the guide shaft, and the rack are beforehand attached to the frame 41. On the other hand, to the stator part 3, the rotor 31, the tie-

down plate 40, the spring 38, and the stopper 39 are incorporated beforehand, and are attached. And the both are made to unify. This unification is performed by making the projecting end of that rotor shaft 34 insert in the metal bearing 37, and making that tie-down plate 40 fit into that metal bearing 37. Adhesion or welding performs immobilization on the frame 41 of the tie-down plate 40.

[0045]According to this 2nd embodiment, the binder 14 is transmitted in the rotor shaft 34, since the slots 34b and 34c of the shape of ** used as the ring are covered, immobilization with the rotor magnet 33 and the rotor shaft 34 is strengthened, the rotor magnet 33 is idle, and the omission of the ** rotor shaft 34 is prevented. Here, the binder 14 with which the **-like slots 34b and 34c are covered constitutes a fixing means.

[0046]in addition -- in the range which is not limited to this and does not deviate from the gist of this invention although each above-mentioned embodiment is an example of the suitable embodiment of this invention -- various -- modification -- it is feasible. For example, immobilization with the rotor magnet 33 and the rotor shaft 34 is used as 34 d of slots of the shape of ** of a meshes-of-a-net form provided in the rotor shaft 34 as shown in drawing 9, or as shown in drawing 10, it is good also as the **-like slot 34e to make the slot of the leading screw of the leading-screw part 35 continue as it is. And as a fixing method of the rotor magnet 33 in the dimorphism voice shown in drawing 9 and drawing 10, and the rotor shaft 34, it is good like a 1st embodiment also as any of form which use insertion form or use the binder 14 like a 2nd embodiment.

[0047]These rotors 1 and 31 are applicable to a stepping motor without a leading screw, and they are applicable to other motors, such as not a stepping motor but AC small synchronous motor. The stepping motors 2 and 32 can be used also for the thing of other uses, such as not the object for videos but an object for the head drive of a floppy disk drive, and an object for the pickup drive of CD-ROM.

[0048]As the **-like slots 4b, 4c, 34b, 34c, 34d, and 34e, It may be made to form the **-like slot over the part, i.e., for

example, the semicircle grade, of the rotor shafts 4 and 34 instead of the perimeter, i.e., 360 degrees, besides considering it as the ring shape over the perimeter of the rotor shafts 4 and 34, or making it spiral shape. When a spacer is put in between the rotor shafts 4 and 34 and the rotor magnets 12 and 33 and it fixes to it, it is preferred to form the slot of the rotor shafts 4 and 34 and the shape of same ** as the spacer. When forming the rotor magnets 12 and 33, a **-like slot is simultaneously formed in the inner surface of the central hole, and the rotor-shaft 4 and 34 side may be made into a flat cylindrical surface, or it may be made to provide a **-like slot. As a slot, it is good as a crepe-like thing besides a **-like slot.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is an important section sectional view of a 1st embodiment of this invention.

[Drawing 2]It is a left side view of drawing 1.

[Drawing 3]It is a right side view of drawing 1.

[Drawing 4]It is a figure showing the side plate of drawing 1, and the important section near a thrust-loading spring, and is the figure seen from the arrow IV direction of drawing 3.

[Drawing 5]It is a figure showing the side plate of drawing 1, and the important section near a thrust-loading spring, and is the figure seen from the direction of arrow V of drawing 3.

[Drawing 6]It is a top view in the state where resin bearing was made to fit into the side plate of drawing 1.

[Drawing 7]It is a top view of the thrust-loading spring of drawing 1.

[Drawing 8]It is an important section sectional view of a 2nd embodiment of this invention.

[Drawing 9]It is a sectional view showing the 1st modification of the rotor of this invention.

[Drawing 10]It is a sectional view showing the 2nd modification of the rotor of this invention.

[Drawing 11]It is a figure showing the conventional stepping motor and its rotor.

[Description of Notations]

1 Rotor

2 Stepping motor

3 Stator part

4 Rotor shaft

4b and 4c **-like slot

5 Leading-screw part

7 Bearing

8 Bearing body

9 Frame

10 Guide shaft

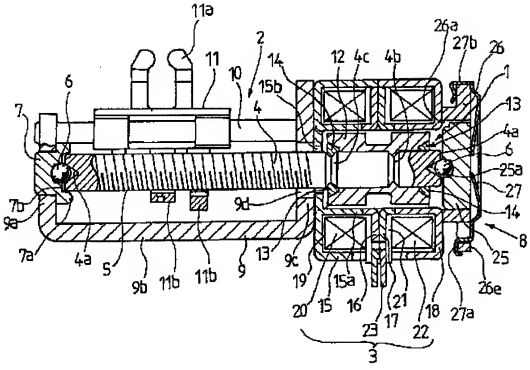
11 Rack

12 Rotor magnet

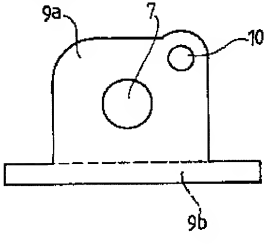
14 Binder (bridging)

DRAWINGS

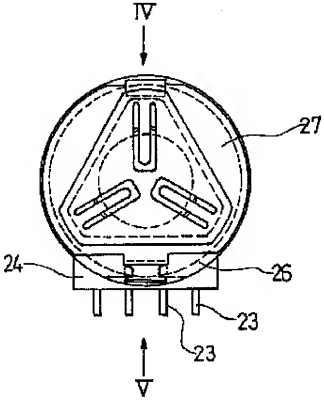
[Drawing 1]



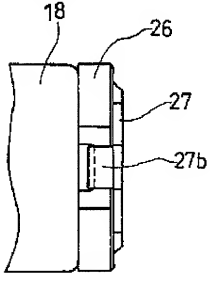
[Drawing 2]



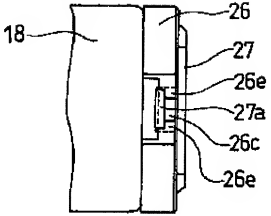
[Drawing 3]



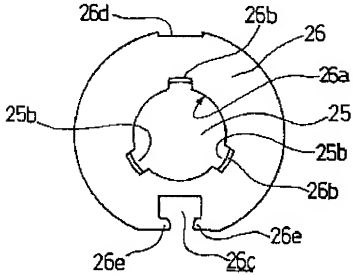
[Drawing 4]



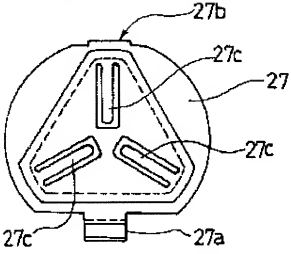
[Drawing 5]



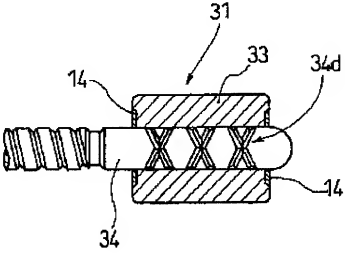
[Drawing 6]



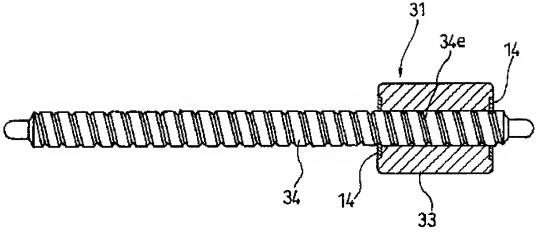
[Drawing 7]



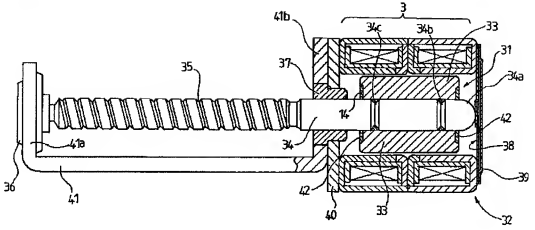
[Drawing 9]



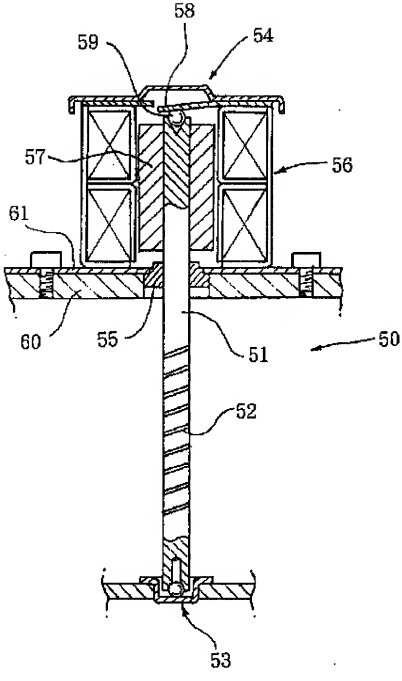
[Drawing 10]



[Drawing 8]



[Drawing 11]



CORRECTION OR AMENDMENT

[Kind of official gazette]Printing of amendment by the regulation of 2 of Article 17 of Patent Law
[Section classification] The 4th classification of the part VII gate
[Publication date]June 8, Heisei 13 (2001.6.8)

[Publication No.]JP,9-219946,A
[Date of Publication]August 19, Heisei 9 (1997.8.19)
[Annual volume number] Publication of patent applications 9-2200
[Application number]Japanese Patent Application No. 8-48101
[The 7th edition of International Patent Classification]
H02K 1/28

1/27 501

37/14 535

37/24

[FI]
H02K 1/28 A

1/27 501 B

37/14 535 M

37/24 L

[Written amendment]
[Filing date]June 3, Heisei 11 (1999.6.3)
[Amendment 1]
[Document to be Amended]Specification
[Item(s) to be Amended]0038
[Method of Amendment]Change
[Proposed Amendment]
[0038]The rotor 31 by which this stepping motor 32 is constituted from the rotor magnet 33 and the rotor shaft 34, The leading-screw part 35 formed in the projection side, and the resin bearing 36 which receives the projection side tip of the rotor shaft 34, The metal bearing 37 which supports the center section of the rotor shaft 34, and the spring 38 which is fixed to the end of the stator part 3 and contacts the end of the rotor shaft 34, The stopper 39 which regulates a motion of the spring 38, and the tie-down plate 40 which fixes the stator part 3, It slides on the frame 41 to which the tie-down plate 40 which fixed the stator 3 adheres, the guide shaft (graphic display abbreviation) fixed to the frame 41, and its guide shaft, and the part mainly comprises a rack for lens maintenance (graphic display abbreviation) which engages with the leading-screw part 35. Let the tip by the side of the spring 38 of the rotor shaft 34 be the semicircle ball-like end 34a.

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報（A）**　(11)特許出願公開番号

特開平9－219946

(43)公開日　平成９年(1997)８月19日

(51)Int.Cl.[6]	識別記号	庁内整理番号	Ｆ Ｉ		技術表示箇所
Ｈ０２Ｋ　1/28			Ｈ０２Ｋ　1/28	Ａ	
1/27	５０１		1/27	５０１Ｂ	
37/14	５３５		37/14	５３５Ｍ	
37/24			37/24	Ｌ	

審査請求　未請求　請求項の数７　ＦＤ　（全　８　頁）

(21)出願番号　特願平８－48101

(22)出願日　平成８年(1996)２月９日

(71)出願人　000002233
株式会社三協精機製作所
長野県諏訪郡下諏訪町5329番地

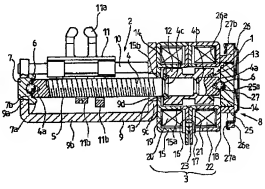
(72)発明者　小澤　滋
長野県飯田市毛賀1020番地　株式会社三協精機製作所飯田工場内

(72)発明者　園原　宏幸
長野県飯田市毛賀1020番地　株式会社三協精機製作所飯田工場内

(74)代理人　弁理士　渡辺　秀治

(54)【発明の名称】　小型モータ用のロータ

(57)【要約】
【課題】　ロータ軸とロータマグネットとの間のずるけや抜けを簡単な構成で確実に防止する。
【解決手段】　この小型モータ用のロータ１では、ロータマグネット１２とロータ軸４とを有し、ロータ軸４に、ロータマグネット１２に対し抜け防止機能を持つ溝部となる条状の溝４ｂ，４Ｃを形成し、その溝４ｂ，４ｃに入れた固定手段となる固定材１４やその溝に入るロータマグネット１２の一部を介して、ロータ軸４とロータマグネット１２とを固定している。



【特許請求の範囲】

【請求項１】　ロータマグネットとロータ軸とを有し、上記ロータ軸に、上記ロータマグネットに対し抜け防止機能を持つ溝部を形成し、その溝部に入る固定手段を介して、上記ロータ軸と上記ロータマグネットとを固定したことを特徴とする小型モータ用のロータ。

【請求項２】　ロータマグネットとロータ軸とを有し、上記ロータ軸に、上記ロータマグネットに対し抜け防止機能を持つ少なくとも１つの条状の溝を形成し、その溝に入れた固定材を介して、上記ロータ軸と上記ロータマグネットとを固定したことを特徴とする小型モータ用のロータ。

【請求項３】　ロータマグネットとロータ軸とを有し、上記ロータ軸に、上記ロータマグネットに対し抜け防止機能を持つ少なくとも１つの条状の溝を形成し、その溝に上記ロータマグネットの一部を嵌合させて、上記ロータ軸と上記ロータマグネットとを固定したことを特徴とする小型モータ用のロータ。

【請求項４】　前記条状の溝を両端がつながったリング状としたことを特徴とする請求項２または３記載の小型モータ用のロータ。

【請求項５】　前記条状の溝を複数条からなる溝とし、該複数の条状の溝のうち少なくとも１つは他の条状の溝に対し逆向きであり、かつ他の条状の溝と重ねて形成したことを特徴とする請求項２または３記載の小型モータ用のロータ。

【請求項６】　前記ロータ軸に、移動部材を係合して移動させるリードスクリュー部を形成し、該リードスクリュー部を前記ロータマグネットとの当接部まで延長させ、このリードスクリューの溝を前記条状の溝としたことを特徴とする請求項２または３記載の小型モータ用のロータ。

【請求項７】　前記条状の溝の一部を、前記ロータマグネットの軸方向端面に設けた凹部に面して形成し、この溝および上記凹部に固定材を入れたことを特徴とする請求項２または３記載の小型モータ用のロータ。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、小型電動機用のロータに関し、特にステッピングモータ用のロータに好適なロータマグネットとロータ軸との固定構造に関する。

【０００２】

【従来の技術】従来、図１１に示すように、ロータ軸５１にリードスクリュー部５２が形成されたステッピングモータ５０は、そのロータ軸５１の両端を２つのスラスト軸受５３．５４でそれぞれ支持される構造となっている。そして、スラスト軸受５４側は、さらに、メタル軸受５５によりラジアル方向の支持をする構成となっている。なお、ロータ軸５１には、ステータ部５６とわずかな隙間をもって対向するようにロータマグネット５７が固着されている。また、この軸受５４は、板バネ５８とボール５９とで構成され、ロータ軸５１のスラスト荷重をこの板バネ５８のバネ圧で移動可能に受け止めている。一方、ステータ部５６は、取付板６１に固定され、この取付板６１がフレーム６０にねじで固定されることにより、フレーム６０にステータ部５６側が固定されている。この固定の際、メタル軸受５５が位置決めのために利用されている。

【０００３】そして、ロータ軸５１とロータマグネット５７とを固定するには、ロータマグネット５７の中にストレート形状のロータ軸５１を圧入することにより行っている。この圧入によって、ロータマグネット５７がロータ軸５１に対し回転方向に位置ずれ、すなわち、ずるけたりしないように、またロータ軸５１がスラスト方向へ抜けてしまわないようにしている。

【０００４】

【発明が解決しようとする課題】しかしながら、このような図１１に示す構造のステッピングモータ５０におけるロータは、ロータマグネット５７にロータ軸５１を圧入し固定しているため、回転に対する強度を上げようとして強く圧入すると、ロータマグネット５７が割れてしまう恐れがある。特に、ロータマグネット５７が薄い場合、その危険性が高くなる。一方、軽圧入にすると、回転に対する強度がなくなり、ロータマグネット５７がロータ軸５１に対してずるけてしまう。このように、その圧入強度の調整が極めて難しいものとなっている。

【０００５】このようなロータマグネット５７の割れやずるけ（位置ずれ）は、ロータマグネット５７が薄い場合だけではなく、圧環強度の小さいロータマグネット５７を使用する場合にも同様に生ずる恐れがある。

【０００６】また、圧入固定を行うためには、ロータマグネット５７の内径寸法やロータ軸５１の外径寸法の精度を上げる必要がある。このため、ロータマグネット５７やロータ軸５１の加工に時間とコストがかかり、生産効率の悪化やコスト上昇を招いている。しかも、上述のように、薄いロータマグネット５７や圧環強度の小さいロータマグネット５７を使用する場合は、一層精度を上げて所定の固定強度を保持させる必要がある。この結果、モータの小型化、高性能化および低コスト化等をはばむ一因ともなっている。

【０００７】本発明は、ロータ軸とロータマグネットとの間のずるけや抜けを簡単な構成で確実に防止した小型モータ用のロータを提供することを目的とする。

【０００８】

【課題を解決するための手段】かかる目的を達成するため、請求項１記載の小型モータ用のロータでは、ロータマグネットとロータ軸とを有し、ロータ軸に、ロータマグネットに対し抜け防止機能を持つ溝部を形成し、その溝部に入る固定手段を介して、ロータ軸とロータマグネットとを固定している。

【０００９】また、請求項２記載の小型モータ用のロータでは、ロータマグネットとロータ軸とを有し、ロータ軸に、ロータマグネットに対し抜け防止機能を持つ少なくとも１つの条状の溝を形成し、その溝に入れた固定材を介して、ロータ軸とロータマグネットとを固定している。

【００１０】また、請求項３記載の小型モータ用のロータでは、ロータマグネットとロータ軸とを有し、ロータ軸に、ロータマグネットに対し抜け防止機能を持つ少なくとも１つの条状の溝を形成し、その溝にロータマグネットの一部を嵌合させて、ロータ軸とロータマグネットとを固定している。

【００１１】さらに、請求項４記載の発明では、請求項２または３記載の小型モータ用のロータにおいて、条状の溝を両端がつながったリング状としている。加えて、請求項５記載の発明では、請求項２または３記載の小型モータ用のロータにおいて、条状の溝を複数条からなる溝とし、該複数の条状の溝のうち少なくとも１つは他の条状の溝に対し逆向きであり、かつ他の条状の溝と重ねて形成している。

【００１２】さらに、請求項６記載の発明では、請求項２または３記載の小型モータ用のロータにおいて、ロータ軸に、移動部材を係合して移動させるリードスクリュー部を形成し、該リードスクリュー部をロータマグネットとの当接部まで延長させ、このリードスクリューの溝を条状の溝としている。また、請求項７記載の発明では、請求項２または３記載の小型モータ用のロータにおいて、条状の溝の一部を、ロータマグネットの軸方向端面に設けた凹部に面して形成し、この溝および凹部に固定材を入れている。

【００１３】本発明の小型モータ用のロータは、抜け防止機能を持つ溝部を形成し、その溝部に入る固定手段を介して、ロータ軸とロータマグネットとを固定している。そして、この溝部の例として条状の溝があり、例えば、少なくとも１つの条状の溝を形成したロータ軸と、ロータマグネットとを、条状の溝に入れた固定材を介したり、条状の溝にロータマグネットの一部を嵌合させたりして固定している。このため、条状の溝に入れた固定材やロータマグネットの一部がロータマグネットのずれけやロータ軸の抜け防止の抵抗となり、ずるけや抜けが生じない。また、溝の形成によって、固定材やロータマグネットとロータ軸との当接面が広くなり、固定強度自体も大きくなる。なお、溝部としては、条状の溝に形成したものの他に、梨地状にしたりしても良い。

【００１４】また、条状の溝を両端がつながったリング状にすると、ロータ軸の抜け方向に対し抵抗が強くなり好ましいものとなる。さらに、複数の条状の溝のうち少なくとも１つを他の溝とは逆向きのものとすると、ずるけと抜けの両作用への抵抗力が増し、両現象を防止するうえで好ましいものとなる。加えて、ロータ軸に設けられるリードスクリュー部の溝をそのまま延長して条状の溝とすれば、条状の溝形成がリードスクリュー部の溝形成と同時に行える。さらに、ロータマグネットの軸方向端面に凹部を設け、その凹部に面して、条状の溝の一部を形成すると、凹部と溝の両部分に同時に固定材を入れることが可能となる。

【００１５】

【発明の実施の形態】以下、本発明の実施の形態を図１から図１０に基づき説明する。なお、最初に第１の実施の形態を図１から図７に基づき説明する。

【００１６】第１の実施の形態のロータ１は、ステッピングモータ２に使用されるものである。そして、このステッピングモータ２は、ビデオカメラのレンズの駆動用で、ステータ部３から突出したロータ軸４を有している。そして、このロータ軸４の突出側には、リードスクリュー部５が形成されており、また、両端には、円錐状の係合孔４ａが形成され、それぞれ鋼球６が当接している。また、ロータ軸４の突出側先端部は、鋼球６が貫入する軸受７で支持され、ステータ側他端部は軸受体８で支持されている。ここで、ロータ軸４の突出先端部の軸受７は、スラスト方向に加え、ラジアル方向も支持する軸受となっている。

【００１７】なお、軸受７とステータ部３は、フレーム９に取り付けられており、このフレーム９にはさらにガイド軸１０が固定されている。そして、このガイド軸１０には、ビデオカメラ用レンズを保持するラック１１が摺動自在に取り付けられている。

【００１８】ロータ１は、ロータ軸４と、その外ロータ軸４に固着されるロータマグネット１２とで構成される。なお、このロータマグネット１２は、ネオジ・鉄・ボロン系の希土類磁石で、インジェクションにより形成されたプラマグとなっている。そして、ロータマグネット１２の形状を、ステータ部３の極歯に対向する部分以外をくぼませた形状とし、イナーシャを小さくしている。また、このロータマグネット１２の軸方向両端には、凹部１３が設けられ、その凹部１３にロータ軸４とロータマグネット１２とを固着するための固定材となる接着材１４が入れられている。

【００１９】一方、ロータ軸４のロータ１を構成する部分は、２つのリングとなった条状の溝４ｂ，４ｃが溝部となるように設けられている。そして、溝４ｂは、ロータマグネット１２の中央より若干軸受体８側に設けられ、溝４ｃは軸受７側の凹部１３に面して設けられている。ここで、ロータ軸４の直径は２ｍｍとっており、一方、各溝４ｂ，４ｃの深さは０．３ｍｍとしている。そして、ロータ軸４の直径が２ｍｍ程度の場合、その深さとしてはロータ軸４の直径の５％～２０％、すなわち０．１ｍｍ～０．４ｍｍ程度とするのが好ましい。

【００２０】ステータ部３は、ケースを兼ねる第１ステータ１５と、この第１ステータ１５の極歯１５ａと交互

に入り組む極歯を有する第２ステータ１６と、この第２ステータ１６と背中合わせに固定される第３ステータ１７と、この第３ステータ１７の極歯と交互に入り組む極歯を有すると共にケースを兼ねる第４ステータ１８と、第１ステータ１５と第２ステータ１６との間に挿入されるドーナツ状のコイルボビン１９と、このコイルボビン１９に巻回されるコイル２０と、第３ステータ１７と第４ステータ１８との間に挿入されるドーナツ状のコイルボビン２１と、このコイルボビン２１に巻回されるコイル２２とで構成される。なお、この構成は、従来公知のステッピングモータのステータ部と同様である。

【００２１】また、このステータ部３の中央部分には、コイル２０，２２に接続される端子２３を有する端子部２４が第１ステータ１５および第４ステータ１８の外方に突出するように形成されている。さらに、第１ステータ１５のフレーム９側は、平板状にされ、フレーム９に溶接により固着されると共に、その中央にはロータ軸４が挿通する挿通孔１５ｂが形成されている。ここで、この挿通されたロータ軸４の外周と挿通孔１５ｂの内周面との隙間は、軸受体８とロータ軸４の同軸度誤差以上とするのが好ましい。また、挿通孔１５ｂの内径は、ロータマグネット１２の外径以下になるように構成されている。

【００２２】ロータ軸４に形成されるリードスクリュー部５は、従来公知のリードスクリューと同様であり、このリードスクリュー部５に係合する被送り体となるラック１１をロータ軸４の回転に伴い、軸方向へ移動させる機能を有している。なお、ロータ軸４の回転方向を切り替えることによって、ラック１１の移動方向を制御している。

【００２３】軸受７は、樹脂軸受とされており、その外周にフレーム９に当接するはかま部７ａを有している。そして、また軸受７の中央には、２段になった凹部７ｂが設けられ、小径の内部側凹部に鋼球６が嵌合し、大径の外部側凹部にロータ軸４が遊合している。これにより、この軸受７は、スラスト方向およびラジアル方向の２方向の支持が可能となっている。

【００２４】軸受体８は樹脂製の樹脂軸受２５と、樹脂軸受２５を軸方向に移動自在に保持する側板２６と、この側板２６に係合すると共に樹脂軸受２５の背部を押圧するスラスト荷重バネ２７とから構成される。

【００２５】そして、樹脂軸受２５には、鋼球６を保持する球受け凹部２５ａが中央に１つ、さらに側板２６の嵌合孔２６ａの内面に形成される案内溝２６ｂに係合する突起２５ｂがその外周に３つ、それぞれ設けられている。

【００２６】また、側板２６は、樹脂軸受２５を軽圧入または遊合により嵌合保持する嵌合孔２６ａと、スラスト荷重バネ２７の一端２７ａが挿通係止される２個の係止突起２６ｅ付きの係止部２６ｃと、スラスト荷重バネ２７の他端２７ｂが係止される凹状の係止部２６ｄとを有する円形板となっている。そして、嵌合孔２６ａの内径をロータマグネット１２の外径より大きくし、側板２６の固定後に、ロータ１、すなわちロータマグネット１２を固着したロータ軸４を組み込めるようにしている。なお、側板２６のステータ部３への固定は、溶接により行われている。

【００２７】スラスト荷重バネ２７は、一枚の金属板を利用して形成されている。このスラスト荷重バネ２７には、係止部２６ｃに挿通される一端２７ａと、凹状の係止部２６ｄに係止される他端２７ｂと、U字状に切り欠かれた残部を樹脂軸受２５側に折り曲げた３つのバネ部２７ｃとが設けられている。そして、バネ部２７ｃが樹脂軸受２５の背部に当接し、この樹脂軸受２５と、鋼球６を介してロータ軸４を押圧している。

【００２８】フレーム９は、コ状に形成され、軸受７を保持する軸受保持部９ａと、このステッピングモータ２をビデオカメラの固定部に取り付けるための台部９ｂと、ステータ３を固着するためのステータ取付部９ｃとを有している。そして、ステータ取付部９ｃには、ロータ軸４との間で十分な隙間を形成するように挿通孔９ｄが設けられている。そして、この挿通孔９ｄと対向する部分までリードスクリュー部５が形成されている。

【００２９】なお、ガイド軸１０は、ロータ軸４と平行となるように一端がフレーム９の軸受保持部９ａに、他端がステータ取付部９ｃにそれぞれ固定されている。そして、このガイド軸１０にラック１１が摺動自在に取り付けられている。このラック１１は、その先端部１１ａで、ビデオカメラ用のレンズ（図示省略）を保持すると共に他端部１１ｂがリードスクリュー部５に係合している。

【００３０】以上のようにステッピングモータ２が構成されると、ステッピングモータ２の組立時においてスラストガタがあったとしても、そのスラストガタは、樹脂軸受２５がスラスト荷重バネ２７によりスラスト方向にバネ付勢されることにより吸収される。このとき、樹脂軸受２５は、側板２６にガイドされているので、ラジアル方向に移動することはない。

【００３１】ここで、ロータ１の組立は、次のように行う。まず、ロータ軸４をインサートする形で、ロータマグネット１２をインジェクションによりロータ軸４に固定する。この後、ロータマグネット１２の軸受体８側の凹部１３に紫外線硬化型の嫌気性接着剤からなる接着材１４を挿入し、紫外線および温度をかけ、固化させる。この後、ロータマグネット１２の軸受７側の凹部１３に同種の接着材１４を挿入し、同様に固化させる。この際、接着材１４は、この凹部１３の他に、溝４ｃ内にも入り、一体的に固化される。なお、溝４ｂ内に入るロータマグネット１２の一部が固定手段を構成する。

【００３２】次に、ステッピングモータ２の組立を行

う。まず、ガイド軸１０とラック１１が設けられたフレーム９に、ステータ部３と軸受７を固定する。その後、軸受７の凹部７ｂに鋼球６を入れる。そして、ロータ１を有するロータ軸４を側板２６の嵌合孔２６ａ，ステータ部３の中央孔、第１ステータの挿通孔１５ｄ、フレーム９の挿通孔９ｄを通して軸受７内の鋼球６にその先端の係合孔４ａを突き当てる。そして、ロータ軸４のステータ部３側の係合孔４ａに鋼球６を入れ、さらに樹脂軸受２５をその鋼球６が凹部２５ａ内に入るように側板２６の嵌合孔２６ａに貫入させる。最後に、スラスト荷重バネ２７を側板２６に取り付け、そのバネ部２７ｃが樹脂軸受２５を介して、ロータ軸４を押圧するように組み付ける。

【００３３】このように構成されるステッピングモータ１の動作は、次のとおりである。すなわち、ステータ部３のコイル２０，２２に電流が流れると、ステータ部３とロータマグネット１２との間の磁気相互作用により、ロータ１が回転し、その結果、ロータ軸４が回転する。すると、リードスクリュー部５が回転し、ラック１１を軸方向に移動させる。

【００３４】このようなラック１１の移動の際、図１１の従来のステッピングモータ５０では、２つのスラスト軸受間のメタル軸受５５によって、カタカタ音が発生したり、回転ロスが生じていたが、このステッピングモータ２では、そのようなメタル軸受がなく、しかもロータ軸４の外周とフレーム９の内周面との間に隙間を設けているので、ロータ軸４がフレーム９や第１ステータ１５に当たることはない。このため、カタカタ音の発生は生ぜず、しかも軸受７および軸受体８の部分以外での摺動ロスが生ずることはない。

【００３５】また、この実施の形態では、条状の溝４ｂ，４ｃがあるため、ロータマグネット１２がロータ軸４に対してずるけにくくなり、しかもロータ軸４が抜けてしまうことがない。さらに、溝４ｃが凹部１３に対向して設けられ、その溝４ｃと凹部１３に接着剤１４が入れられるため、接着強度が高いものとなる。

【００３６】なお、この実施の形態では、側板２６の嵌合孔２６ａの内径を、ロータマグネット１２の外径より大きくしているので、側板２６をステータ部３に組み付けてからロータ軸４を有するロータ１を組み付けることができる。また、この実施の形態では、従来の中央のメタル軸受５５がないのに加え、フレーム９の挿通孔９ｄを大きくしているので、リードスクリュー部５をロータ１の方向へ長くとることができる。例えば、図１に示すように、挿通孔９ｄの所まで螺旋状の溝を形成することができる。このため、最も安定したピッチとなるリードスクリュー部５の中央部分を、ラック１１の送り動作のために使用することができる。さらに、スラスト荷重バネ２７が一枚の金属から形成され、その金属板にはバネ部２７ｃ等が設けられているので、部品点数が増加せず、しかも組み立てが容易となる。

【００３７】次に、図８に基づいて、第２の実施の形態を説明する。このロータ３１もステッピングモータ３２に使用されるものであり、このステッピングモータ３２も第１の実施の形態と同様にビデオカメラのレンズ駆動用のものとなっている。なお、この実施の形態の説明にあたって、第１の実施の形態と同部材には同一の符号をもって示すこととする。

【００３８】このステッピングモータ３２は、ロータマグネット３３とロータ軸３４とから構成されるロータ３１と、突出側に形成されたリードスクリュー部３５と、ロータ軸３４の突出側先端を受ける樹脂軸受３６と、ロータ軸４の中央部を支持するメタル軸受３７と、ステータ部３の一端に固定され、ロータ軸４の一端に当接するバネ３８と、バネ３８の動きを規制するストッパー３９と、ステータ部３を固定する取付板４０と、ステータ３を固定した取付板４０が固着されるフレーム４１と、フレーム４１に固定されるガイド軸（図示省略）と、そのガイド軸に摺動し、その一部がリードスクリュー部３５に係合するレンズ保持用のラック（図示省略）とから主に構成されている。なお、ロータ軸３４のバネ３８側の先端は半円球状の端部３４ａとされている。

【００３９】ロータ３１のロータマグネット３３は、全体が円筒形状とされたネオジ・鉄・ボロン系の希土類磁石となっており、かつインジェクションにより形成されたプラマグとなっている。そして、このロータマグネット３３の軸方向両端には、凹部４２が形成され、その凹部４２にロータ軸３４とロータマグネット３３とを固着するための固定材となる接着材１４が入れられている。

【００４０】一方、ロータ３１を構成するロータ軸３４には、リングとされた条状の溝３４ｂ，３４ｃの深さが設けられている。なお、溝３４ｂ，３４ｃの深さは０．３mmとされ、ロータ軸３４の直径（２mm）に対し１５%程度の深さとされている。なお、この深さは、第１の実施の形態と同様に５%～２０%の範囲とするのが好ましい。

【００４１】リードスクリュー部３５のリードスクリューと、ステータ部３は共に従来公知のものと同様であり、また第１の実施の形態と同様となっている。なお、リードスクリュー部３５のリードスクリューは、第１の実施の形態と異なり、軸受３７の手前までしか形成されていない。また、樹脂軸受３６は、フレーム４１の一方の折曲端部４１ａに嵌合保持され、メタル軸受３７は、フレーム４１の他方の折曲端部４１ｂに嵌合保持されている。

【００４２】バネ３８は一枚の金属板からそのバネ部を切り出し、わずかに内方に曲げて形成されている。そして、そのバネ部がロータ軸３４の端部３４ａに当接し、ロータ軸３４を他方側に押圧している。また、ストッパー３９は、バネ３８を保持すると共にそれ自体はステー

タ部３に溶接により固着されている。そして、ロータ軸３４がバネ部側に移動してきた際の移動阻止機能を果たしている。取付板４０は、ステータ部３を固定すると共にフレーム４１の折曲端部４１ｂに固定される。そして、その中央の嵌合孔にメタル軸受３７の一部が嵌合している。

【００４３】ここでは、ロータ３１の組立は、次のように行う。まず、ロータマグネット３３の中央孔にロータ軸３４を挿入する。このとき、ロータ軸３４の外径は、ロータマグネット３３の中央孔の内径に比べ１０～１００μｍ程度小さくされており、両方は圧入ではなく遊合状態とされている。この後、ロータマグネット３３の一方の凹部４２に紫外線硬化型の嫌気性接着剤からなる接着材１４を入れ、紫外線および温度をかけて固化させる。なお、この接着材１４を凹部４２に入れる際、接着材１４の一部は、ロータ軸３４を伝わり溝３４ｂ，３４ｃに溜まることとなる。そして、さらに、ロータマグネット３３の他方の凹部４２に同様に接着材１４を入れるが、このとき也接着材１４の一部がロータ軸３４を伝わり、溝３４ｂ，３４ｃに溜まることとなる。この後、同様に接着材１４を固化させる。

【００４４】次に、このステッピングモータ３２の組立を説明する。まず、フレーム４１に、樹脂軸受３６とメタル軸受３７とガイド軸とラックとを予め取り付けておく。一方、ステータ部３に対し、ロータ３１と取付板４０とバネ３８とストッパー３９とを予め組み込み、かつ取り付けておく。そして、その両者を一体化させる。この一体化は、そのロータ軸３４の突出端をメタル軸受３７に挿通させ、その取付板４０をそのメタル軸受３７に嵌合させることにより行う。なお、取付板４０のフレーム４１への固定は、接着ないしは溶接によって行う。

【００４５】この第２の実施の形態では、接着材１４がロータ軸３４を伝わり、リングとされた条状の溝３４ｂ，３４ｃに溜まるため、ロータマグネット３３とロータ軸３４との固定が強化され、ロータマグネット３３のずるけやロータ軸３４の抜けが防止される。ここで、条状の溝３４ｂ，３４ｃに溜まる接着材１４が固定手段を構成する。

【００４６】なお、上述の各実施の形態は、本発明の好適な実施の形態の例であるが、これに限定されるものではなく、本発明の要旨を逸脱しない範囲において、種々変形実施可能である。例えば、ロータマグネット３３とロータ軸３４との固定を図９に示すように、ロータ軸３４に設けた網目形の条状の溝３４ｄとしたり、図１０に示すように、リードスクリュー部３５のリードスクリューの溝をそのまま連続させて条状の溝３４ｅとしても良い。そして、図９および図１０に示す両形態におけるロータマグネット３３とロータ軸３４の固定方法としては、第１の実施の形態のように、インサート形式にしたり、第２の実施の形態のように、接着材１４を利用する形式のいずれとしても良い。

【００４７】また、このロータ１，３１は、リードスクリューを持たないステッピングモータに適用できると共にステッピングモータではなく、ＡＣ小型同期モータ等他のモータに適用することができる。さらに、ステッピングモータ２，３２は、ビデオ用ではなくフロッピーディスクドライブのヘッド駆動用やＣＤ－ＲＯＭのピックアップ駆動用等他の用途のものにも使用できる。

【００４８】さらに、条状の溝４ｂ，４ｃ，３４ｂ，３４ｃ，３４ｄ，３４ｅとしては、ロータ軸４，３４の全周に渡るリング状としたりスパイラル状にする以外に、全周すなわち３６０度ではなくロータ軸４，３４の一部すなわちたとえば半周程度に渡る条状の溝を形成するようにしても良い。また、ロータ軸４，３４とロータマグネット１２，３３との間にスペーサを入れて固定する場合は、ロータ軸４，３４およびそのスペーサに同様な条状の溝を形成するようにするのが好ましい。また、ロータマグネット１２，３３を形成する際、その中央孔の内面に条状の溝を同時に形成するようにし、ロータ軸４，３４側はフラットな円柱面にしたり、または条状の溝を設けるようにしても良い。また、溝部としては、条状の溝の他に梨地状のものとしても良い。

【００４９】

【発明の効果】以上説明したように、請求項１、２、３および４記載の小型モータ用ロータでは、ロータ軸に条状の溝等の溝部を形成して、その溝部に、固定手段なる接着材等の固定材やロータマグネット一部を入れて、ロータマグネットとロータ軸とを一体化しているので、ロータマグネットがずるけたり、ロータ軸が抜けたりする危険性が大幅に減少する。しかも、条状の溝等の溝部は、ロータ軸に切削工具を当て、そのロータ軸を回転させることなどにより、簡単に形成できるので、コストおよび生産効率も従来に比べそれ程落ちることがない。

【００５０】加えて、請求項５記載の発明では、逆向きの条状の溝が形成されるので、ロータ軸の抜けが一層防止される。さらに、請求項６記載の発明では、リードスクリューの溝を条状の溝として利用しているので、条状の溝形成が極めて簡単かつ効率的に行える。

【００５１】また、請求項７記載の発明では、ロータマグネットの軸方向端面に設けた凹部に対向して条状の溝の一部を配置し、この溝と凹部に固定材を入れたので、固定強度が高くなり、ずるけや抜けが一層防止される。

【図面の簡単な説明】

【図１】本発明の第１の実施の形態の要部断面図である。

【図２】図１の左側面図である。

【図３】図１の右側面図である。

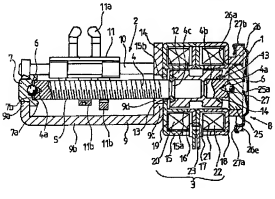
【図４】図１の側板とスラスト荷重バネ付近の要部を示す図で、図３の矢示Ⅳ方向から見た図である。

【図５】図１の側板とスラスト荷重バネ付近の要部を示

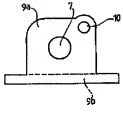
す図で、図3の矢示Ｖ方向から見た図である。
【図６】図１の側板に樹脂軸受を嵌合させた状態の平面図である。
【図７】図１のスラスト荷重バネの平面図である。
【図８】本発明の第２の実施の形態の要部断面図である。
【図９】本発明のロータの第１の変形例を示す断面図である。
【図１０】本発明のロータの第２の変形例を示す断面図である。
【図１１】従来のステッピングモータとそのロータを示す図である。
【符号の説明】

１　ロータ
２　ステッピングモータ
３　ステータ部
４　ロータ軸
４ｂ，４ｃ　条状の溝
５　リードスクリュー部
７　軸受
８　軸受体
９　フレーム
１０　ガイド軸
１１　ラック
１２　ロータマグネット
１４　接着材（固定材）

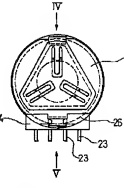
【図１】



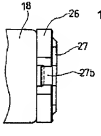
【図２】



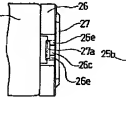
【図３】



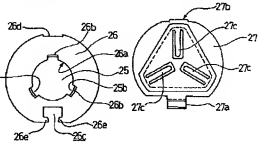
【図４】



【図５】

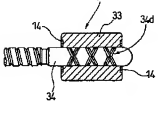


【図６】

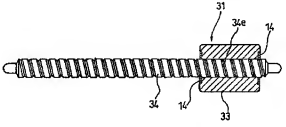


【図７】

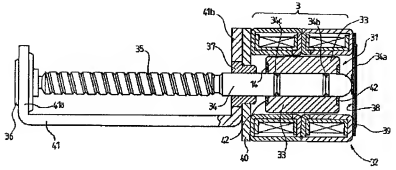
【図９】



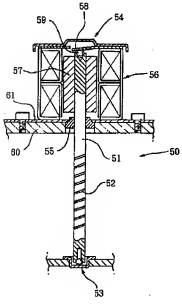
【図１０】



【図８】


3
41b
34c
34b
33
37
37
34a
35
42
38
39
34
42
40
33
22
36
41
41a

【図１１】


58
59
54
57
56
61
60
55
51
50
52
53